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RS 3434/32
ATOMIC WEAPON DATA

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HISTORY OF THE XW-51 WARHEAD (U)

SC-M-67-683



SC-M-67-683
RS-3434/32

Weapon Systems

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Timetable of XW-51 Events

- 2/7/58 Assistant Secretary of Defense requests United States Atomic Energy Commission to assist in feasibility study of warhead for the FALCON, an Air Force air-to-air missile.
- 2/18/58 Phase 2 feasibility study reports that FALCON warhead could not be developed by February 1960. (b)(1), (b)(3)
- 2/19/58 Assistant Secretary of Defense requests Atomic Energy Commission to study feasibility of warhead for an Army ground-to-ground missile. Consideration to be given to a design that could also be used with the FALCON.
- 3/19/58 Special Weapons Development Board discusses NUTCRACKER weapons. (b)(1), (b)(3)
- (b)(1), (b)(3)
- 4/23/58 Special Weapons Development Board studies DAVY CROCKETT, an Army ground-to-ground missile. (b)(1), (b)(3)
- Sandia starts component
- ~~development.~~
- 6/23/58 Assistant Secretary of Defense requests Atomic Energy Commission to develop one warhead for both FALCON and DAVY CROCKETT applications. An improved nuclear design, using less plutonium, to be provided as soon as possible.
- 7/16/58 Division of Military Application suggests that the Radiation Laboratory be assigned nuclear development responsibility for FALCON and DAVY CROCKETT warheads. (b)(1), (b)(3)
- 9/24/58 Nomenclature of XW-51 assigned to FALCON and DAVY CROCKETT warhead development.

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(b)(1), (b)(3)

It was expected that a fairly large quantity of these weapons would be required, with early deliveries starting in February 1960.^{3,4}

The feasibility report was released by the Air Force Special Weapons Center February 18, 1958, and concluded that existing weapon commitments would not permit development of a warhead compatible with FALCON and which could meet the desired operational availability date.

(b)(1), (b)(3)

The Assistant Secretary of Defense notified the Atomic Energy Commission February 19, 1958 that the Army desired a lightweight, simple, ground-to-ground nuclear-weapon delivery system which could carry a small, low-yield warhead. This system would be used by the Battle Groups of the Pentomic Divisions. Study had indicated that an acceptable system might be developed in a relatively short period of time, and consideration of a suitable warhead was requested.

(b)(1), (b)(3)

It was hoped that the design could be produced by 1960, and it was requested that consideration be given to a warhead that could also be applied to the FALCON missile.²

The Special Weapons Development Board met March 19, 1958, and discussed a proposed series of low-yield, nuclear, ground-to-ground, close-support devices called NUTCRACKER which would supplement existing weapon systems. These devices would provide mobility, ability to fire on short notice, would limit effects to the Commander's area of responsibility, assure safety to friendly troops, and result in minimum damage to nontarget areas.

Since recoilless rifles had light weight and inherent accuracy, it was felt that these weapons might be used to deliver a nuclear payload. Sandia had previously

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requested Frankford Arsenal to investigate the environment that a weapon launched from a recoilless rifle would experience, and results of the study had indicated that the rifle would subject the warhead to lower setback forces than were created by existing atomic artillery shells.

As a result of the study, two rifle systems had been proposed. One would have a diameter of 6 inches and be spigot-fired, with the diameter of the projectile being larger than the rifle bore. The other would have a diameter of 13 inches. The rifle barrels would be made of fiberglass and be discarded after each round.

(b)(1), (b)(3)

University of California Radiation Laboratory personnel described a warhead that could be used in the NUTCRACKER series.

(b)(1), (b)(3)

The Special Weapons Development Board met April 23, 1958, and noted that the DAVY CROCKETT, a member of the NUTCRACKER series suggested by Sandia, would be spigot-fired from a 6-inch recoilless rifle.⁸ The system would have a useful range of 350 to 2000 meters, an overall weight of about 100 pounds, and could be transported by two men.

(b)(1), (b)(3)

A cruciform-shaped afterbody would be 33 inches long, and the range could be extended by providing a longer afterbody.⁹

(b)(1), (b)(3)

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(b)(1), (b)(3)

Sandia started component development work. A safety switch would be needed for the DAVY CROCKETT application that would sense acceleration, but would not operate unless a minimum level of 1000 g's was experienced. A squib-initiated 28-volt thermal battery would be required with a rise time of less than 1 second and an output of 4 amperes. A timer would be squib-initiated and have a 5-second interval.¹¹

The Assistant Secretary of Defense notified the United States Atomic Energy Commission June 23, 1958, that it was technically feasible to develop suitable warheads for the FALCON or GAR-11 and the DAVY CROCKETT or the Battle Group Atomic Delivery System, and the Joint Chiefs of Staff had established a requirement for a single warhead for both applications.

(b)(1), (b)(3)

Sandia-Livermore sent a teletype to Albuquerque Operations Office, June 24, 1958, noting that the FALCON and DAVY CROCKETT missiles had different acceleration regimes. The FALCON experienced a boost phase of about 20 g's for 2 seconds, producing a speed of about 1700 feet per second above the velocity of the launch aircraft. The DAVY CROCKETT experienced an acceleration of 2500 g's, resulting in a speed of 500 feet per second. It appeared doubtful whether the same type of safety switch (to prevent premature detonation) could be designed and used.¹³

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The Division of Military Application requested Albuquerque Operations Office, July 16, 1958, to assign nuclear development responsibilities for the FALCON and DAVY CROCKETT warheads to the Radiation Laboratory. It was hoped that one warhead could be provided for both applications.¹⁴

The Army notified Sandia July 23, 1958, that recent developments in the Middle East had emphasized DAVY CROCKETT desirability, and that the Army had internally accorded this program the highest possible priority. The Secretary of the Army had recommended to the Department of Defense that this system be given a national urgency equal to that of the intercontinental ballistic missile and the antimissile missile.¹⁵

(b)(1), (b)(3)

Sandia notified Albuquerque Operations Office September 24, 1958, that nomenclature of XW-51 had been assigned to the warhead.¹⁷ The military characteristics for an

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atomic warhead for the FALCON and DAVY CROCKETT were approved by the Military Liaison Committee October 21, 1958.

(b)(1), (b)(3)

If technically feasible, a warhead for both applications would be provided in one basic design.

Maximum economy of nuclear material was a major design objective. Other features of interest included safety from nuclear disaster to friendly troops and installations, acceptable reliability, minimum weight, simplicity and ease of maintenance, and minimum use of reactor products. 18

The Division of Military Application, November 14, 1958, requested that the Lawrence Radiation Laboratory and Sandia join with the Air Force and the Army in development engineering of the FALCON and DAVY CROCKETT warhead installations. 19

(b)(1), (b)(3)

The Group would reconvene December 4, 1958. 20

(b)(3)

The design would also meet requirements for the DAVY CROCKETT system and would be capable of withstanding the acceleration imparted to the warhead by the recoilless rifle.

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Glossary of XW-51 Terms

Air Force Special Weapons Center -- That element of the Air Force Systems Command having to do with compatibility testing of nuclear devices with aircraft. Located at Kirtland Air Force Base, Albuquerque, New Mexico.

Albuquerque Operations Office -- The local office of the Atomic Energy Commission (AEC) concerned with the operations of Sandia Corporation.

Armed Forces Special Weapons Project -- An interdepartmental agency formed to handle military functions related to atomic weapons.

Assistant Secretary of Defense -- Created by Department of Defense directive, June 30, 1953, as part of DOD reorganization. Handles research and development activities of the DOD.

(b)(1), (b)(3)

Department of Defense -- The Armed Forces, i.e., the Army, Navy and Air Force.

Division of Military Application -- An AEC office that functions as liaison between the Military and weapons designers and producers.

Field Command -- The local office of the Armed Forces Special Weapons Project (Defense Atomic Support Agency), located on Sandia Base, Albuquerque, New Mexico.

(b)(1), (b)(3)

Hardtack -- A nuclear series of 72 tests. Hardtack I was held at the Pacific Proving Grounds from April 28 to August 18, 1958. The decision to declare a moratorium on testing resulted in Hardtack II, held at the Nevada Test Site between September 12 and October 30, 1958.

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(b)(1), (b)(3)

Joint Chiefs of Staff -- A group composed of the Chiefs of Staff of the Army, Navy and Air Force, to determine policy and develop joint strategic objectives of the Armed Forces.

Kilogram -- A metric weight approximating 2.2 pounds.

Kiloton -- A means of measuring the yield of an atomic device by comparing its output with the effect of an explosion of TNT. A 1-kiloton yield is equivalent to the detonation effect of 1000 tons of high explosive.

Lawrence Radiation Laboratory -- A change of name for the University of California Radiation Laboratory (which see), effective October 1958.

Lenses -- As applied to nuclear weapons, lenses are elements of the high-explosive sphere, which are designed to produce an implosion. The lens charge is composed of high explosives of different burning rates and is so constructed and shaped as to change the explosion initiated by the detonators into an implosive force which converges smoothly on the nuclear materials.

Los Alamos Scientific Laboratory -- A nuclear design organization located at Los Alamos, New Mexico.

Military Characteristics -- The attributes of a weapon that are desired by the Military.

Military Liaison Committee -- A Department of Defense committee established by the Atomic Energy Act to advise and consult with the AEC on all matters relating to military applications of atomic energy.

(b)(1), (b)(3)

One-Point-Safe Weapon -- A weapon that will not produce a nuclear yield when detonated at one point on the surface of the high explosive.

Operation Hardtack -- See Hardtack.

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(b)(1), (b)(3)

Radar -- Named for Radio Detecting and Ranging. Radars emit a pulse of high-frequency energy and measure the time lapse from that transmission to receipt of a reflected electrical "echo" from an object. This time measurement determines the distance of the object from the transmitting antenna of the radar.

Special Weapons Development Board -- Change of name for the Sandia Weapons Development Board, effective May 14, 1952.

Squib -- A device containing a small powder charge. When detonated, the resulting gas pressure closes a switch or performs a similar action. A light, quick-acting, one-shot device.

Thermal Battery -- A battery whose electrolyte is in a solid state while inactive. To activate, heat is applied to this electrolyte, melting it and putting the battery into active output condition.

Ton (Yield) -- A means of measuring the yield of an atomic device by comparing its output with the effect of an explosion of TNT. A 1-ton yield is equivalent to the detonation effect of 2000 pounds of high explosive.

Tritium -- The hydrogen isotope of mass number 3.

University of California Radiation Laboratory -- A laboratory established at Livermore, California. Initially founded for work on thermonuclear designs.

Uranium-235 -- A radioactive element, an isotope of uranium-238.

Uranium-238 -- A radioactive element, atomic number 92. Natural uranium contains about 99.3-percent uranium-238; the rest is uranium-235.

Warhead -- A weapon carried to the target by missile.

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13. SRD TWX, RS 8000/22, Sandia-Livermore to Albuquerque Operations Office, dtd 6/24/58. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.
 14. SRD Ltr, RS 3466/70375, Division of Military Application to Albuquerque Operations Office, dtd 7/16/58, subject, Warhead for DAVY CROCKETT and FALCON. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.
 15. SRD Ltr, RS 3466/70423, Chief of Research and Development, Department of the Army, to Sandia Corporation, dtd 7/23/58. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.

16.

(b)(3)

17. SRD Ltr, RS 1000/3293, Sandia Corporation to Albuquerque Operations Office, dtd 9/24/58, subject, Weapon Development Program Number Assignment. SC Central Technical Files, 51 Program.
18. SRD Report, Military Liaison Committee to Distribution, dtd 10/21/58, subject, Military Characteristics for Atomic Warhead for Battle Group Atomic Delivery (DAVY CROCKETT) System and the FALCON (GAR-11) Missile. SC Central Technical Files, Mk 54, 2-, 1959-60.
19. SRD Ltr, RS 3466/73449, Albuquerque Operations Office to Lawrence Radiation Laboratory and Sandia Corporation, dtd 11/25/58, subject, Phase 3 Authorization for a Warhead for DAVY CROCKETT and FALCON. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.
20. SRD TWX, RS 3466/73486, Field Command to Picatinny Arsenal, dtd 12/1/58. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.
21. SRD Report, RS 3466/73804, Los Alamos Scientific Laboratory to Distribution, dtd 12/8/58, subject, DAVY CROCKETT and GAR-11. SC Central Technical Files, 51/DAVY CROCKETT, NUTCRACKER.

22.

(b)(3)

23. SRD TWX, RS 3466/73989, Division of Military Application to Albuquerque Operations Office, dtd 1/15/59. SC Central Technical Files, 54 Program, DAVY CROCKETT, 1958-9.

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